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The Relationship of Housing and Industrial Factors with the Outbreak of COVID-19 in Urban Areas Using Geographical Information Systems (GIS) Pathum-Thani Province, Thailand.

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Abstract:- This research was export factor research. The purpose of this study is to investigate the association between housing and industrial factors and the Covid-19 outbreak in Pathum-Thani province, Thailand. Using Geographic Information Systems (GIS). Pathum Thani province's seven districts served as the study's focus. There are 3,297 industrial enterprises in the area, as well as 234,673 factory employees. Secondary data from government agencies was collected, including housing and industrial data, the registered population, laborer statistics, industry areas, and industry waste water. In addition, we collected the incidence and prevalence of Covid-19 in the seven districts of Pathum-Thani province. In order to use the data in the research, surveys were also conducted in each of the seven districts. The statistics mean, percentage, frequency, and standard deviation were used. Determine the relationship between the variables using correlation statistics. This study was conducted between March to May of 2021.

The study's findings revealed that the laborator factor was significantly associated with the covid-19 case at the 0.05 level, and in the same direction as the association (r=0.809). The number of factories was significantly associated with covid-19 cases at the 0.05 level, and in the same direction at the high level (r=0.756). A spatial map was built utilizing GIS as a tool for site planning and real-time. Recommendations should encourage the implementation of a much more effective Covid-19 control and prevention programme to help relevant organizations. Continue to expand the use of GIS in public health.

Keywords:- *Housing, Industrial, Covid-19, Geographic Information Systems (GIS).*

I. INTRODUCTION

The coronavirus is a category of animal virus which is available in a variety of strains. It does not normally cause disease in humans, but when mutated into a new pathogenic strain, it does. An outbreak of human disease occurs while humans are not yet known or immune to disease. The first case of the patient was discovered in December 2019 in Wuhan, China, a densely populated city, so the outbreak rapidly spread. The care was emergency, and the number of sick and dying people was so high that China had to shut down the city and, later, the country. China is now so under control that there are almost no new cases, but there are still people infected. Never before has the world been concerned about a global health crisis as the COVID-19 outbreak that has ravaged the world. The World Health Organization (WHO) has officially named the new coronavirus disease "COVID-19," a combination of the terms Coronavirus and Infectious Disease. In addition, the epidemic began in the year 2019.[1]

The majority of people infected with the COVID-19 virus will most likely have a mild to moderate respiratory infection and will thus recover without the need for special treatment. Adults over the age of 65, as well as those with pre-existing medical conditions such as cardiovascular disease, diabetes, chronic respiratory disease, and cancer, are at a higher risk of developing serious disease. [2] In Thailand, during April to May 2020, 598 people died as a result of Coronavirus 2019. The average number of deaths per day is 19, with the highest number of deaths per day being 35. The male-female ratio was 1.3 to 1. The majority of deaths (65 %) had a history of exposure to a previous infection as a result of traveling across the province to return to their homeland during the previous grand festival.[3]

Thailand's COVID-19 epidemic situation management center has upgraded steps as the epidemic situation worsens, especially in Bangkok and metropolitan areas. New control areas have been developed to change the extent of region classification and compliance measures: 1. the highest and stringent control areas (dark red) in six provinces are as follows: Bangkok, Chonburi, Nonthaburi, Chiang-Mai, Samut-Prakan, and Pathum-Thani. 2. the overall control area (red) consists of 45 provinces, and 3. controlled areas (orange) consist of 26 provinces. The major points in each new adjustment zone are quite similar, except for the more conservative and strict or dark red zones throughout the six provinces. Follow policies for wearing a mask while leaving the house or in public places. Food and beverage stores only sell food and drinks, which are then consumed at home. Meat, beer, and alcoholic drinks are not permitted in the store, which is open until 9:00 p.m. The stadium, exercise services, gym, and fitness center are all closed. Although outdoor fitness services are needed until 9:00 p.m., and sporting activities will take place without fans in the stadium. Department stores, shopping centers, and other related facilities can run normally until 21.00 p.m. Limiting the number of service users and refraining from organizing promotional events are also essential. The service is not available for arcade machines, game machines, game stores, or amusement parks. Convenience stores, supermarkets, night markets, and walking street markets are open as usual from 4 a.m. to 23 p.m. Traveling outside the area, on the other hand, is strictly forbidden for people in the most strictly regulated areas. Refrain from moving outside the area unless absolutely necessary to minimize travel that could expose you to Covid-19. Furthermore, government agencies and business owners consider employees to work at home for at least 14 days in order to minimize individual inclusion.From 4 a.m. to 23 p.m., convenience stores, supermarkets, night markets, and walking Street Markets are open as usual.[4] Pathum-Thani Province has the highest level of control in Thailand, with a COVID-19 situation. There were several cases and deaths. In addition, there is a dense urban area with a large industrial area. As of May 10, 2021, the following districts had the most cases: Muang district had 57 cases, Klong-Luang had 145 cases, Thanyaburi had 96 cases, Nong-Suea had 6 cases, Lat Lum-Kaeo had 8 cases, Lam Luk-Ka had 72 cases, and Sam-Khok had 11 cases, with a total of 395 cases and seven deaths.[5]

The literature review found that addressing the improvement of living conditions and surveillance mechanisms, migrant workers' social and geographic networks should be included in the deployment of lockdown exit options. To reduce unnecessary gatherings, essential services like as remittance and grocery shopping must be located near dorms.[6] There was an association between the spread of the pandemic and population density and distance from public locations. Furthermore, regional disparities in environmental factor effects, including positive and negative affects, were detected in different areas of the examined region.[7] Therefore, researchers are interested in studying The relationship of housing and industrial factors with the outbreak of COVID-19 in urban areas using Geographical Information Systems (GIS), Pathum-Thani province, Thailand. The goal of this research is to investigate the relationship between housing and industrial factors and the Covid-19 epidemic in Pathum- Thani province.

II. METHOD

Export Factor Research is a Geographic information system study of the association between housing and industry factors on Covid-19 events in Pathum-Thani province. This research was conducted from March to May of 2021. Area of Study Pathum Thani province was chosen because it had the highest level of the Covid-19 outbreak, which was continually categorized in Thailand's dark red area throughout the second epidemic. There are 3,297 industrial enterprises in the area, as well as 234,673 employees from other areas. Secondary data from government agencies, such as housing and industrial data, the registered populace, laborer statistics, industry areas and industry waste water. Statistics on Covid-19 occurrences were gathered in Pathum-Thani province's seven districts from the Ministry of Public Health. There were also surveys conducted in each of the seven districts in order to use the data in the research. The following statistics were used: mean, percentage, frequency, and standard deviation. Using correlation statistics, determine the association between the variables. We're exploring correlations based on research objects to help us design a much more effective Covid-19 control and prevention program. According to migrant workers' social and geographic networks, tighter departure strategies, as well as improved living circumstances and monitoring systems, should be established. To alleviate congestion, basic services like as remittance and grocery shopping should be situated near dorms.[6] County-level or place-based characteristics such as average household size, population density, and minority composition were found to be significant predictors of COVID-19 cases in nursing homes. These findings provide a foundation for further investigation of COVID-19 cases and emphasize the need to address additional community-level characteristics when assessing the risk of COVID-19 transmission and outbreaks.[8]

III. RESULT

According to the findings, the registered population was identified in the following districts: figure 1 shows that the population of Muang district was 3,503 people, Klong-Luang district had 78,467 people, Thanyaburi district had 52,916 people, Nong-Suea district had 42,306 people, Lat Lum-Kaeo district had 38,642 people, Lam Luk-Ka district had 13,483 people, and Sam-Khok district had 427,284 people. As illustrated in figure 2, housing was discovered in the following districts: Muang district had 732, Klong-Luang district had 20,264, Thanyaburi district had 16,711, Nong-Suea district had 10,211, Lat Lum-Kaeo district had 10,118, Lam Luk-Ka district had 36,887, and Sam-Khok district had 12,324. According to the findings, the following districts have the most number of ca*ses as of May 10, 2021: f*igure *3* shows that Muang district had 57 cases, Klong-Luang district had 145 cases, Thanyaburi district had 96 cases, Nong-Suea district had 6 cases, Lat Lum-Kaeo district had 8 cases, Lam Luk-Ka district had 72 cases, and Sam-Khok district had 11

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cases, for a total of 395 cases and 7 deaths. The results shows, the factory laborers were found in the following districts: Muang district had 46,363 people, Klong-Luang district had 103,031 people, Thanyaburi district had 16,870 people, Nong-Suea district had 2,502 people, Lat Lum-Kaeo district had 22,529 people, Lam Luk-Ka district had 33,378 people, and Sam-Khok district had 10,116 people, as shown in figure 4.

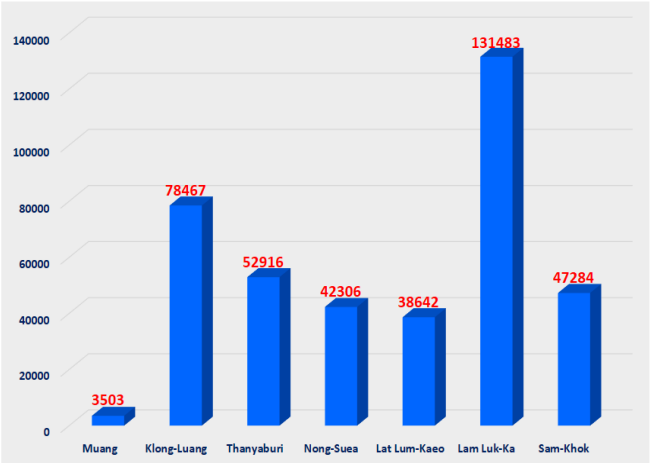

Figure 1; The registered population

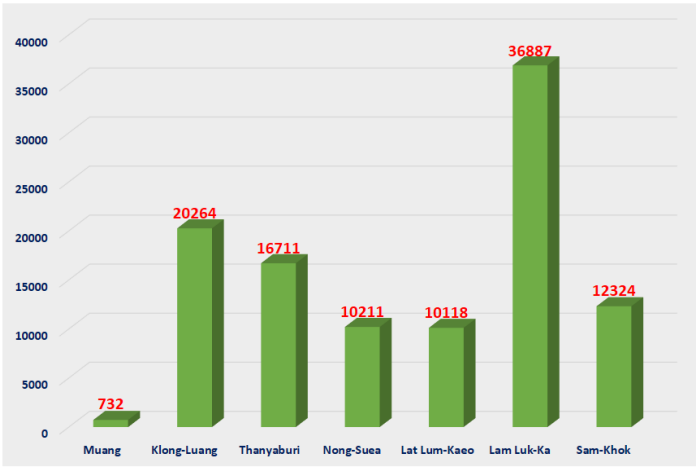

Figure 2; Housing

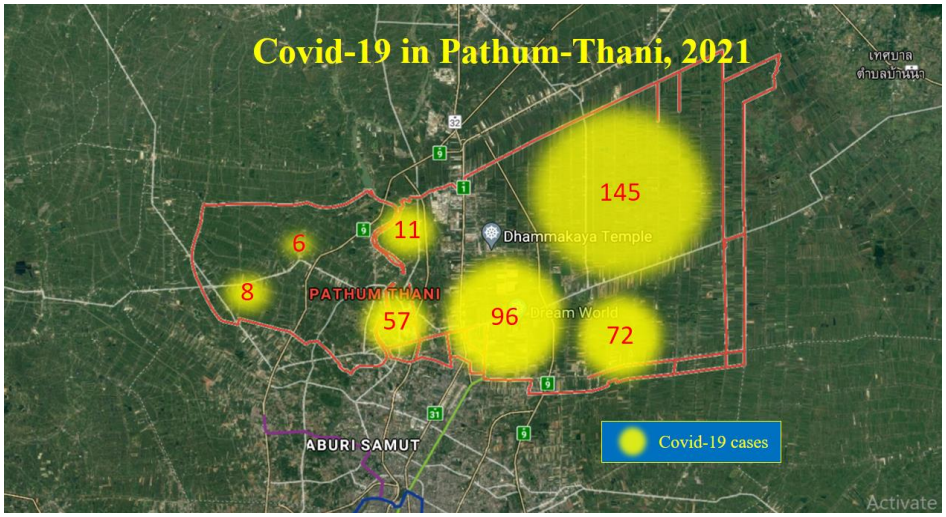

Figure 3; Covid-19 cases

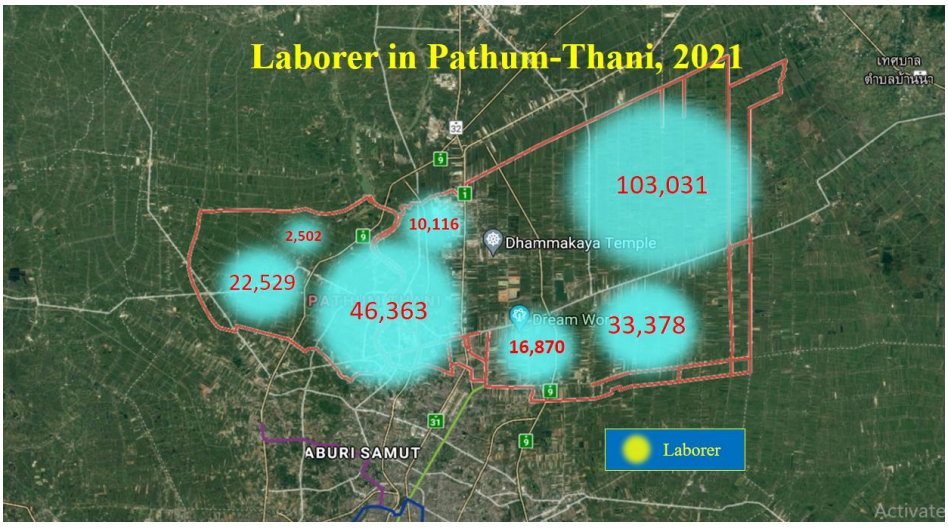

Figure 4; Laborer

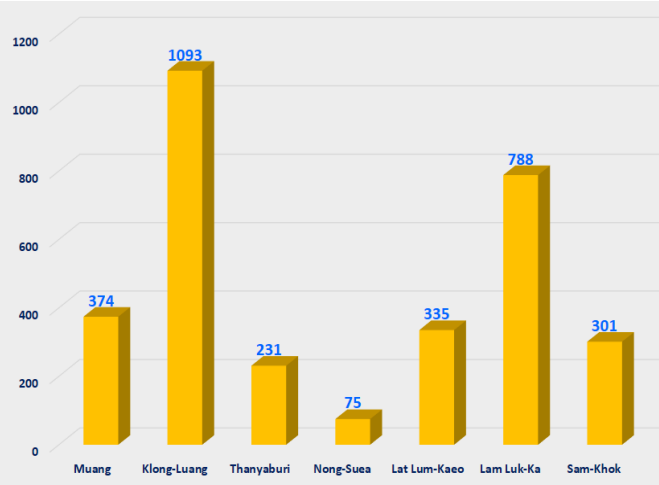

Figure 5; The number of factory

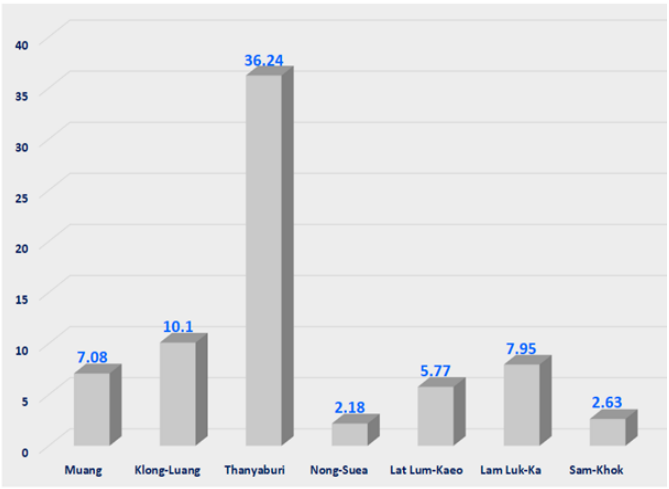

Figure 6; Industry areas

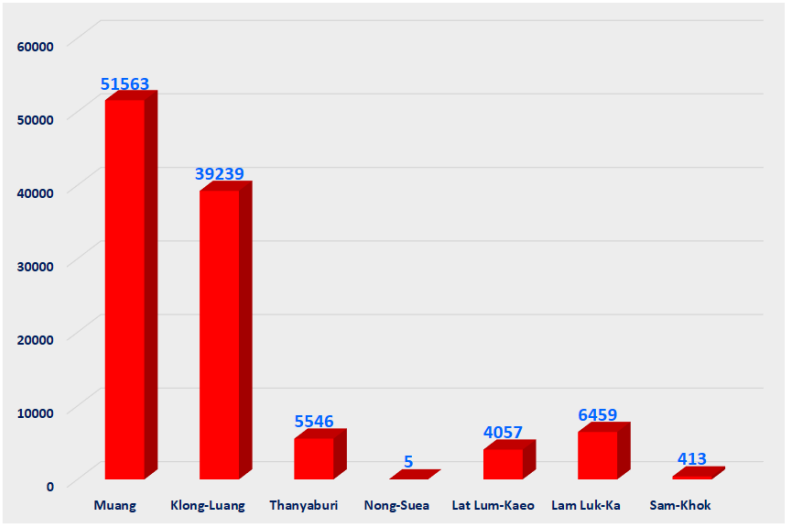

Figure 7; Industry waste water

Table 1. Illustrates the correlation between the housing factor and the factory factor with the Covid-19 cases.

Factors	Covid-19 cases		
	Pearson Correlation(r)	Sig. (2-tailed)	Relationship level
The registered populace	0.393	0.384	No relationship
Housing	0.411	0.360	No relationship
Laborer	0.809	0.028*	High-level relationships
Factory	0.756	0.049*	High-level relationships
Industry areas	-0.337	0.460	No relationship
Industry waste water	0.545	0.206	No relationship

According to the results, 374 factories were located in Muang district, 1093 in Klong-Luang district, 231 in Thanyaburi district, 75 in Nong-Suea district, 335 in Lat Lum-Kaeo district, 788 in Lam Luk-Ka district, and 301 in Sam-Khok district, as shown in figure 5. Industry areas were discovered in the following districts, as shown in figure 6: Muang district (7.08 km^2), Klong-Luang district (10.1 km^2), Thanyaburi district (36.24 km^2), Nong-Suea district (2.18 km^2), Lat Lum-Kaeo district (5.77 km^2), Lam Luk-Ka district (7.95 km^2), and Sam-Khok district (2.63 km^2). Figure 7 presents the discovery of industrial waste water in the following districts: Muang (51,563 m^3/day), Klong-Luang (39,239 m^3/day), Thanyaburi (5,546 m^3/day), Nong-Suea (5 m^3/day), Lat Lum-Kaeo (4,057 m^3/day), Lam Luk-Ka (6,459 m^3/day), and Sam-Khok (413 m^3/day). Using correlation statistical analysis to discover the relationship from table 1, the laborer factor was significantly associated with the covid-19 case, at the level of 0.05, and in the same direction as the association, at a high level (r=0.809). At the level of 0.05, the number of factories was significantly associated with covid-19 cases, and at the high level (r=0.756) in the same direction. While the registered populace, housing, industrial areas, and industrial waste water factor were unrelated to Covid-19 cases.

IV. CONCLUSION AND DISCUSSION

The results of this study showed the laborer factor was significantly associated with the covid-19 case. This might have been caused by the large number of employees and congested residences, which might affect their practice of new normal practices and make them lackadaisical, thereby harming the larger Covid-19 outbreak. Consistent with health equity considerations in COVID-19: geospatial network analysis of the COVID-19 outbreak in the migrant population in Singapore. COVID-19 risk exposure was shown to be related to dormitory density. The migrant worker hub in the city center was the most commonly frequented for necessary services such as food shopping and remittance, followed by south central districts primarily for social gathering. With a cluster of employees exposed to COVID-19, the hub was positioned as the core with the greatest degree of centrality, as reported by Yi H. et al.,)2021(.[6] It was inconsistent with the results of the study of The impact of social vulnerability on COVID-19 in the US: an analysis of spatially varying relationships. Overall, COVID-19 infection was predicted by minority status and language, family composition and transportation, and housing and disability, as reported by Karaye IM et al.,)2020(.[9]

However, the result showed the number of factories was significantly associated with covid-19 cases, and at the high level (r=0.756) in the same direction. This is why there are more factories, more workers, more congestion, and a large number of work groups. The occurrence of covid-19 incidents may occur in addition to the movement of workers from time to time. According to studies in Knowledge, attitude, practices related to dengue fever among rural population in Terengganu, Malaysia. The results showed as major outbreaks frequently occur in industrial and mining industries, we notice an association between industrial locations with high employment rates, high mobility, and significant support for the governing party with the number of confirmed cases of Covid-19, as represented by Jarynowski A. et al.,)2020(.[10] According to studies in health equity considerations in COVID-19: geospatial network analysis of the COVID-19 outbreak in the migrant population in Singapore., as reported by Yi H. et al.,)2021(.[6]

However, as Pathum-Thani province is home to numerous factories, the development of the Covid-19 preventive and control method is still required to investigate all components of housing and plant factors in order to make timely corrections due to changing factors. Every time this encompasses both personal and community influences. Furthermore, GIS has always been a key component of the driver.

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